The Geographic Information System in Transient Groundwater Flow Modeling

Development of a transient groundwater flow model on a regional scale requires the management of a significant amount of data. Typically, regional groundwater modeling requires the study area be subdivided into a large number of cells. Each cell is then assigned qualitative and quantitative attributes that define the hydraulic characteristics of the system in space and time. As stated by Richards et al. (1993), "Managing the data, assembling model input files, and analyzing the model results is typically a complicated, cumbersome, time consuming process which includes many opportunities for data entry or data management errors." Integrating the Geographic Information System (GIS) in transient groundwater flow modeling significantly improves the analysis of data. It enhances the reliability of the analysis by automating processes that generate input files and/or graphic outputs. The GIS reduces the number of manual steps necessary to set up the model; therefore, minimizing the opportunities for management errors. This article highlights some of the benefits of using the GIS as a tool to manipulate, store, query, and retrieve data associated with regional transient groundwater flow modeling efforts. This article is a brief excerpt from the information presented by Vera (2010).
The GIS can be used to generate input files and output graphics readily, saving time and minimizing the risk for errors. The GIS possesses the ability to identify, select and extract spatially referenced data (e.g., wells, recharge components, aquifer parameters, etc.) readily for the study area to support the development of transient models. The GIS also provides the modeler with an opportunity to expedite generation of groundwater flow model input files through pre-processing. Pre-processing can be achieved by embedding codes directly into the GIS which allows a rapid conversion of spatially referenced data into groundwater flow models (e.g., MODFLOW) input files. Visualizing user interfaces (e.g., GMS®, Groundwater Vistas®, etc.) output data in the GIS either by color-filling techniques or through the use of contour lines assists the modeler/viewer to analyze the results of the model in time and in space.

Generating output graphics using the GIS provides a better regional perspective of the distribution of anticipated water level and groundwater flow changes in the study area resulting from changes in pumping and recharge conditions within the simulation period. The GIS provides the ability to identify potential areas of concern (highest drawdown), the efficiency of aquifer recharge projects (water level rise), and the proximity of these areas to key locations such as wellfields, residential areas, water bodies, roads, etc. The GIS also provides an effective platform to store large amount of transient and spatially referenced data for easy access and distribution. Also, the GIS is proven to be an effective tool for the design of groundwater level and groundwater quality monitoring networks resulting from the modeling efforts by allowing model results to be displayed on top of surface water feature coverages such as wetlands or lakes. Finally, the GIS can be used to estimate the depth at which data loggers should be appropriately installed in monitoring wells to ensure reliability and continuity of the data logging.

References:

AUTHOR: Oscar Vera, P.E., Ph.D., is a Lead Engineer with Parsons Brinckerhoff in Orlando, FL. Email: Vera@pbworld.com

Upcoming FWEA Events
SEP 29 - West Coast Chapter Annual Roundtable Lunch
SEP 30 - Southwest Chapter Golf Tournament
OCT 7 - Treasure Coast Golf Tournament
OCT 22 - Florida Water Festival
OCT 26 - Biosolids Management Seminar
OCT 31 Florida Benchmarking Seminar
DEC 6 - Big Bend Winter Seminar

For more information of any of the above events, please visit www.fwea.org
Calendar of Events

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 4, 2011</td>
<td>IWRC Meeting Teleconference</td>
</tr>
<tr>
<td>November 8, 2011</td>
<td>IWRC Meeting Teleconference</td>
</tr>
<tr>
<td>December 6, 2011</td>
<td>IWRC Meeting Teleconference</td>
</tr>
<tr>
<td>January 10, 2011</td>
<td>IWRC Meeting Teleconference</td>
</tr>
</tbody>
</table>

The 3rd Biennial UF Water Institute Symposium
February 15-16, 2012
J. Wayne Reitz Union, University of Florida Campus, Gainesville, Florida

Join us to explore complex, emerging issues related to nutrient sources, dynamics, management and policy from multiple perspectives.

Dates of Interest:
* Call for Abstracts - August 16, 2011
* Abstract submission Deadline - October 10, 2011

For sponsorship opportunities contact: Lisette Staal, lstaal@ufl.edu

For more information go to: http://waterinstitute.ufl.edu/symposium2012/